1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^3 + 95x^2 - 142x + 40$$

A. $z_1 \in [-0.9, -0.5]$, $z_2 \in [-0.76, -0.27]$, and $z_3 \in [4.8, 5.7]$

B. $z_1 \in [-5.3, -4.7]$, $z_2 \in [1.02, 1.34]$, and $z_3 \in [2.4, 2.9]$

C. $z_1 \in [-3.7, -1.8]$, $z_2 \in [-1.31, -1.16]$, and $z_3 \in [4.8, 5.7]$

D. $z_1 \in [-5.3, -4.7]$, $z_2 \in [0.06, 0.68]$, and $z_3 \in [0, 1.3]$

E. $z_1 \in [-4.5, -3.8]$, $z_2 \in [-0.24, 0.01]$, and $z_3 \in [4.8, 5.7]$

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2. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 3x^4 + 6x^3 + 4x^2 + 4x + 4$$

A. $\pm 1, \pm 3$

B. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 4}$

C. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 3}$

D. $\pm 1, \pm 2, \pm 4$

E. There is no formula or theorem that tells us all possible Integer roots.

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3. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 6x^3 - 7x^2 - 43x + 30$$

A. $z_1 \in [-4.9, -2.9]$, $z_2 \in [-0.92, -0.59]$, and $z_3 \in [1.97, 2.57]$

B. $z_1 \in [-1.6, 0.4]$, $z_2 \in [1.39, 1.65]$, and $z_3 \in [2.75, 3.19]$

C. $z_1 \in [-4.9, -2.9]$, $z_2 \in [-1.53, -1.44]$, and $z_3 \in [0.34, 0.48]$

D. $z_1 \in [-2.9, -1.4]$, $z_2 \in [0.64, 0.91]$, and $z_3 \in [2.75, 3.19]$

E. $z_1 \in [-4.9, -2.9]$, $z_2 \in [-0.55, -0.24]$, and $z_3 \in [4.43, 5.47]$

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4. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{4x^3 - 48x + 62}{x + 4}$$

A. $a \in [0, 12], b \in [-20.8, -19.5], c \in [50, 56]$, and $r \in [-204, -197]$.

B. $a \in [0, 12], b \in [-16.8, -15.2], c \in [13, 21]$, and $r \in [-5, 2]$.

C. $a \in [-18, -9], b \in [63.5, 64.5], c \in [-305, -296]$, and $r \in [1278, 1285]$.

D. $a \in [-18, -9], b \in [-64.7, -61.4], c \in [-305, -296]$, and $r \in [-1157, -1149]$.

E. $a \in [0, 12], b \in [15, 17], c \in [13, 21]$, and $r \in [121, 133]$.

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5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 - 83x^2 + 185x - 97}{x - 5}$$

A. $a \in [5, 18]$, $b \in [-47, -38]$, $c \in [13, 15]$, and $r \in [-50, -41]$.

B. $a \in [5, 18]$, $b \in [-39, -28]$, $c \in [20, 28]$, and $r \in [1, 4]$.

C. $a \in [49, 56]$, $b \in [163, 172]$, $c \in [1018, 1024]$, and $r \in [4997, 5007]$.

D. $a \in [5, 18]$, $b \in [-136, -132]$, $c \in [847, 853]$, and $r \in [-4349, -4342]$.

E. $a \in [49, 56]$, $b \in [-333, -331]$, $c \in [1850, 1852]$, and $r \in [-9348, -9342]$.

---

6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 - 26x - 16}{x - 2}$$

A. $a \in [3, 12], b \in [15, 18], c \in [-2, 7]$, and $r \in [-5, -1]$.

B. $a \in [14, 18], b \in [-32, -28], c \in [33, 39]$, and $r \in [-94, -91]$.

C. $a \in [3, 12], b \in [-16, -14], c \in [-2, 7]$, and $r \in [-28, -22]$.

D. $a \in [14, 18], b \in [25, 38], c \in [33, 39]$, and $r \in [58, 66]$.

E. $a \in [3, 12], b \in [4, 12], c \in [-19, -15]$, and $r \in [-34, -33]$.

---

7. Factor the polynomial below completely, knowing that $x+3$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 20x^4 - 7x^3 - 356x^2 - 515x - 150$$

A. $z_1 \in [-8, -4]$, $z_2 \in [0.78, 1.7], z_3 \in [2.36, 2.74]$, and $z_4 \in [3, 4]$

B. $z_1 \in [-3, 1]$, $z_2 \in [-1.93, -0.42], z_3 \in [-0.44, -0.28]$, and $z_4 \in [5, 11]$

C. $z_1 \in [-3, 1]$, $z_2 \in [-2.71, -2.11], z_3 \in [-0.87, -0.74]$, and $z_4 \in [5, 11]$

D. $z_1 \in [-8, -4]$, $z_2 \in [-0.41, 0.22], z_3 \in [2.8, 3.08]$, and $z_4 \in [5, 11]$

E. $z_1 \in [-8, -4]$, $z_2 \in [0.23, 0.55], z_3 \in [1.17, 1.32]$, and $z_4 \in [3, 4]$

---

8. Factor the polynomial below completely, knowing that $x+2$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 6x^4 + 7x^3 - 44x^2 - 28x + 80$$

A. $z_1 \in [-2.92, -2.27]$, $z_2 \in [-2.01, -1.97], z_3 \in [1.29, 1.44]$, and $z_4 \in [0.97, 2.24]$

B. $z_1 \in [-4.34, -3.25]$, $z_2 \in [-2.01, -1.97], z_3 \in [0.81, 0.87]$, and $z_4 \in [0.97, 2.24]$

C. $z_1 \in [-2.23, -1.75]$, $z_2 \in [-1.36, -1.26], z_3 \in [1.96, 2.01]$, and $z_4 \in [2.2, 2.56]$

D. $z_1 \in [-2.23, -1.75]$, $z_2 \in [-0.64, -0.23]$, $z_3 \in [0.71, 0.78]$, and $z_4 \in [0.97, 2.24]$

E. $z_1 \in [-2.23, -1.75]$, $z_2 \in [-0.98, -0.48]$, $z_3 \in [0.33, 0.41]$, and $z_4 \in [0.97, 2.24]$

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9. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 6x^3 + 6x^2 + 6x + 5$$

A. $\pm 1, \pm 5$

B. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 3, \pm 6}$

C. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 5}$

D. $\pm 1, \pm 2, \pm 3, \pm 6$

E. There is no formula or theorem that tells us all possible Integer roots.

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10. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{25x^3 + 80x^2 + 9x - 15}{x + 3}$$

A. $a \in [23, 28]$, $b \in [-20, -14]$, $c \in [89, 90]$, and $r \in [-372, -364]$.

B. $a \in [23, 28]$, $b \in [1, 11]$, $c \in [-6, 3]$, and $r \in [3, 6]$.

C. $a \in [-76, -72]$, $b \in [304, 309]$, $c \in [-908, -902]$, and $r \in [2702, 2704]$.

D. $a \in [-76, -72]$, $b \in [-149, -135]$, $c \in [-429, -423]$, and $r \in [-1293, -1287]$.

E. $a \in [23, 28]$, $b \in [154, 156]$, $c \in [465, 479]$, and $r \in [1401, 1410]$.
